

# Inventory of salinity and selenium concentrations in surface water, groundwater, and biota of Hailstone and Halfbreed National Wildlife Refuges following the 2011 Hailstone dam breach

FY15

## PROJECT DESCRIPTION

Hailstone and Halfbreed National Wildlife Refuges (NWR), located in Northern Stillwater County, Montana are satellite refuges managed by the Charles M. Russell NWR Complex. They are both located in Lake Basin, a closed basin whose terminus is Big Lake, a State Wildlife Management Area (WMA). Lake Basin is highly susceptible to saline seep development from crop fallow agricultural practices, and since the 1950's, saline-seep development has impacted the water quality on Hailstone and Halfbreed NWRs. In fact, Nelson and Reiten (2005) have observed several mortality events due to salt-encrustation on feathers of ducks and a selenium hazard assessment indicated that selenium levels in Hailstone Reservoir had the potential to cause complete reproductive failure in sensitive waterfowl and shorebirds.

Hailstone Reservoir dam on Hailstone NWR was breached during the fall of 2011 to reduce the unacceptable risk posed to waterfowl and shorebirds using the refuge. The purpose of this project is to provide a post-dam breach inventory of selenium and salinity levels across various components of the ecosystem and conduct a teratogenic risk assessment for sensitive avian species. This will be completed at areas within Hailstone and Halfbreed NWRs, as well as Big Lake WMA. These are all conditions outlined in the Memorandum of Agreement (MOA) between the U.S. Fish and Wildlife Service (Service) and the Montana Department of Environmental Quality (2009) and the Hailstone dam removal Environmental Assessment (EA) (U.S. Fish and Wildlife Service 2010).

## OBJECTIVES

1. Provide a post-dam breach inventory of water quality, with an emphasis on salinity and selenium in surface water bodies and shallow aquifers of the Lake Basin watershed.
2. Provide a post-dam breach inventory of selenium concentrations in benthic macroinvertebrates in surface water bodies at and below the historic Hailstone Reservoir
3. Conduct a teratogenic risk assessment for sensitive bird species through the collection and analysis of bird eggs at locations at and below the historic Hailstone Reservoir

## METHODS AND PROTOCOLS

Field water quality measurements have and will be taken and single surface water grab samples have and will be collected and analyzed for selenium and major ions every year beginning in 2014 for three years at the following sites: East Hailstone Tributary, West Hailstone Tributary, Hailstone Creek, Halfbreed Lake, Goose Lake, Grass Lake, Big Lake, and Cedar Creek.

Field water quality measurements have and will be taken and single samples have and will be collected and analyzed for selenium and major ions starting in 2014 for three years at eight groundwater monitoring wells that include two monitoring wells along Hailstone Creek in Hailstone NWR and six monitoring wells located in Halfbreed NWR.

Benthic macroinvertebrates were collected at the sites Hailstone Creek, Halfbreed Lake, Grass Lake, and Big Lake and analyzed for selenium.

For the teratogenic risk assessment, up to 10 American Avocet eggs were collected at Hailstone NWR and Big Lake and analyzed for selenium.

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## DATA ANALYSIS

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A quotient method, or the ratio of the measured concentration to an effects concentration for a particular contaminant, will be implemented to evaluate selenium concentrations found in surface water and macroinvertebrates (USEPA 1998). A trend analysis using the Mann-Kendall trend test will be done for groundwater and surface water specific conductivity and will incorporate data collected in previous projects during and after the dam breach, but before this inventory project (Mann 1945, Kendall 1975). Predicted rates of avian teratogenesis will be calculated using bird embryo selenium concentrations (NIWQP 2003).

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## CURRENT STATUS

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Two of the three years of inventory data collection have been complete. This includes annual surface water and groundwater monitoring and biota sampling during fy14. Specifically, surface water field water quality measurements were taken and dissolved water samples were collected for metal and ion analyses at the following sites in fy15: Big Lake, Goose Lake, Grass Lake, Halfbreed Lake, West Hailstone Tributary, and Hailstone Creek. The sites east tributary and Cedar Creek were dry. Groundwater quality field measurements were taken and dissolved water samples were collected for metal and ion analyses at the two proposed monitoring wells along Hailstone Creek and the six proposed monitoring wells at Halfbreed NWR.

To date, all laboratory results are complete and available for all of the samples collected except the fy15 metals data for surface water and groundwater.

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## CHALLENGES

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Locating Anatidae nests for egg collection has been unsuccessful, but the targeted sample size of Recurvirostridae eggs was reached in fy14 at two locations and extrapolations can be made from this data to other species of birds (NIWQP 2003). Further, historic Recurvirostridae egg data exists and the collection of eggs in fy15 will allow for greater temporal, as well as geographic comparisons to be made within a single species. Also, American Coot eggs were collected at Halfbreed NWR during fy15 and will provide important information regarding selenium exposure to animals at Halfbreed Lake.

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## MORE INFORMATION

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## LITERATURE CITATION

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Nelson, K.J., and Reiten, J.C., 2005, Saline seep impacts on Hailstone and Halfbreed National Wildlife Refuges in South-Central Montana: U.S. Fish and Wildlife, Region 6, Environmental Contaminants Program Report, DEC ID: 200160001, FFS: 61130-6N47

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